

Increased marine heat waves, a major impact of climate change in the Mediterranean

Motivation

A constant and steady warming of the Mediterranean temperature has been reported in the recent years. Parallel to this is the increased frequency of extreme temperature recordings, which can lead to Marine Heat Wave (MHW) events, which have direct effects on the marine biology and the atmosphere-ocean interface through increased evaporation and heat fluxes. This makes necessary to deepen of understanding the characteristics of this phenomena as well as to study their temporal evolution in the Mediterranean basin.

Data and methods

Sea surface temperature data used come from the GHRST Level 4 AVHRR_OI Global Blended Sea Surface Temperature Analysis (GDS2) from NCEI available from PODAAC. Dataset accessed 2022-01-15 at <https://doi.org/10.5067/GHAAO-4BC21>. For the detection and analysis of MHWs the heatwaveR package has been used (<https://robwschlegel.github.io/heatwaveR/index.html>)

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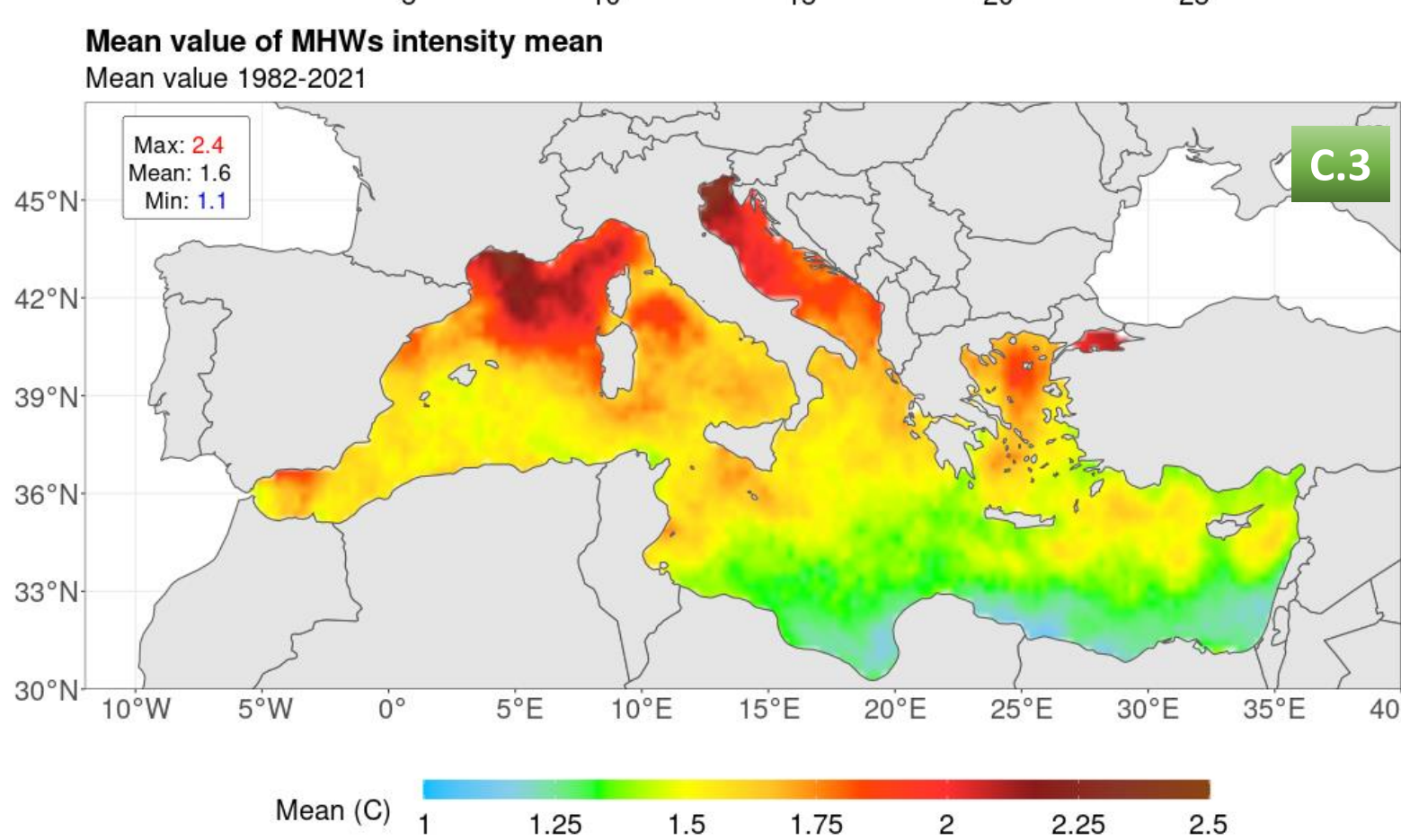
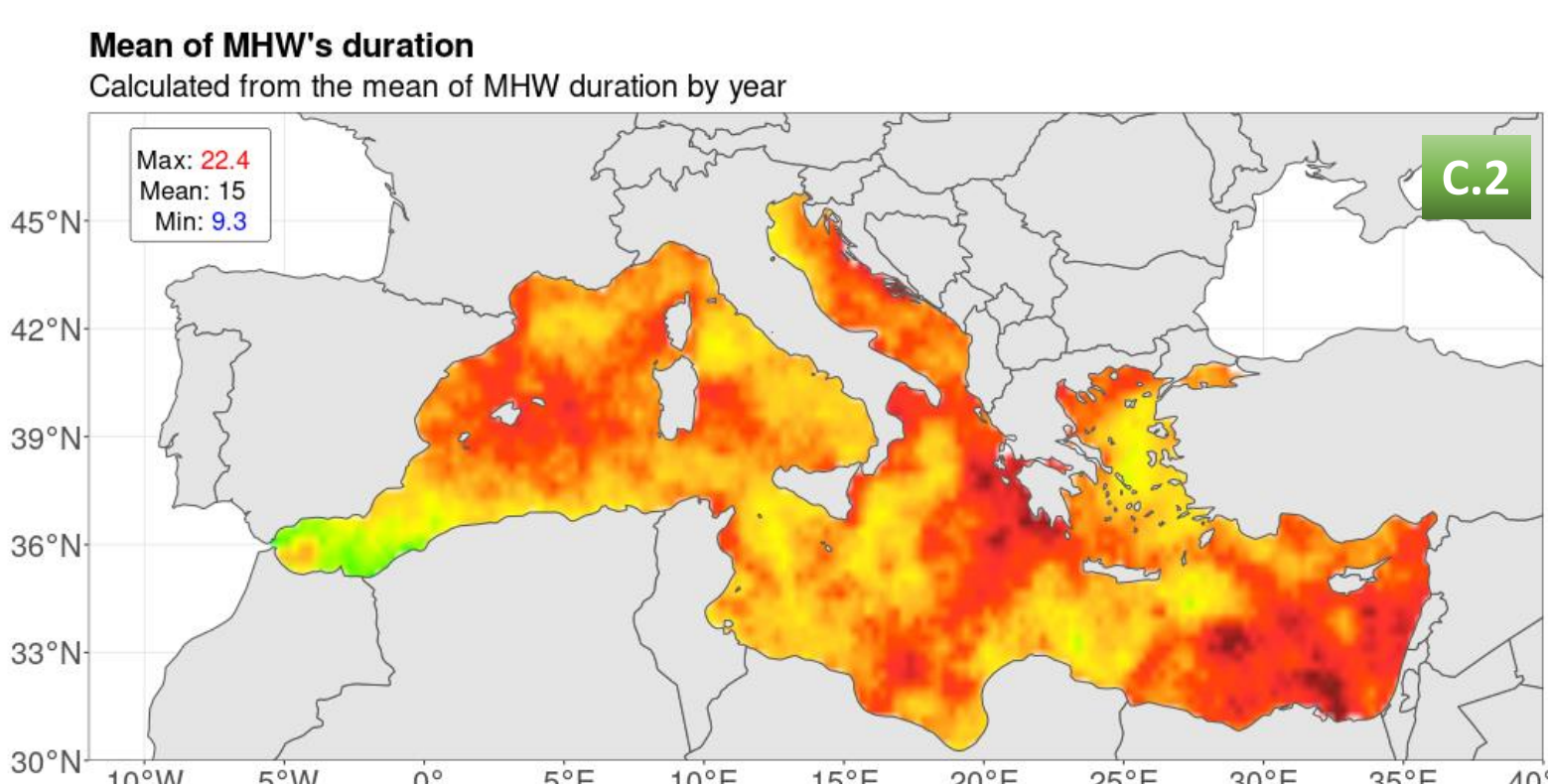
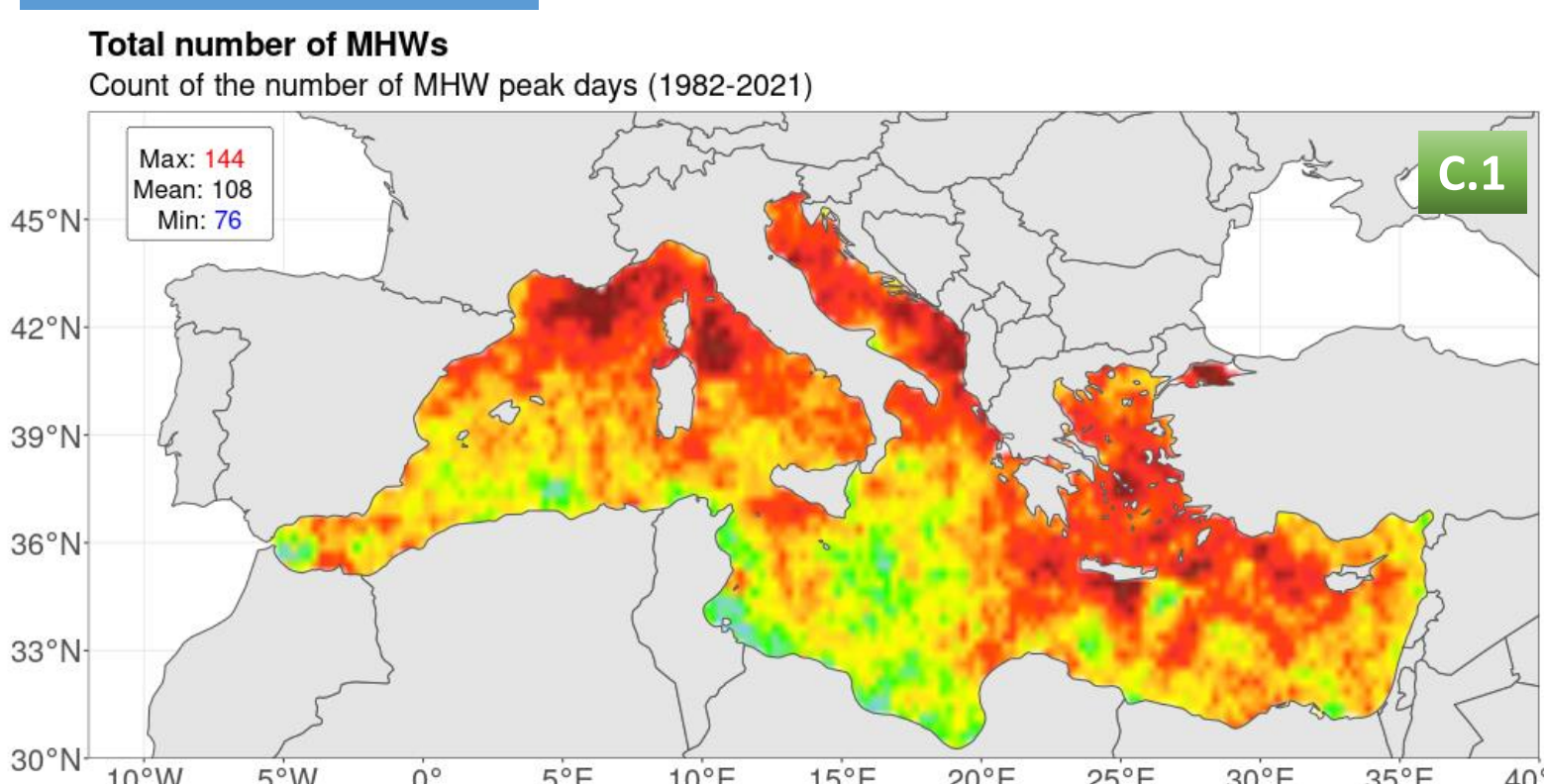


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CHARACTERIZATION

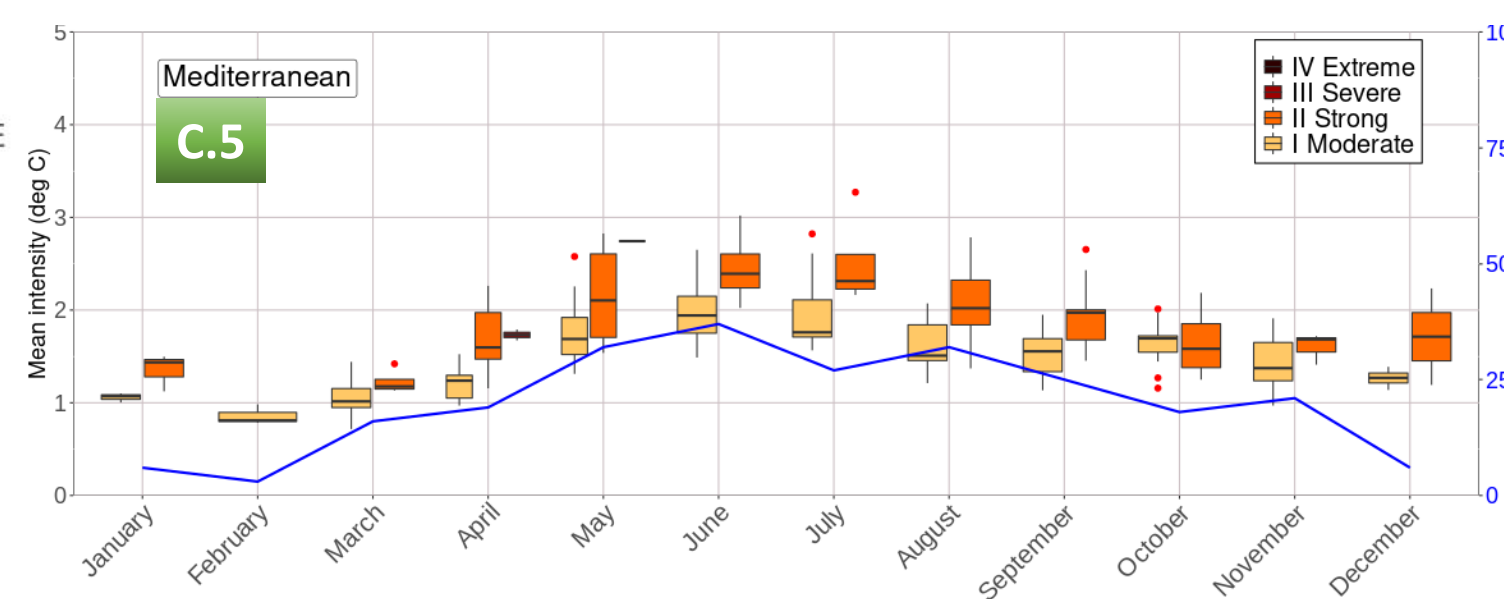
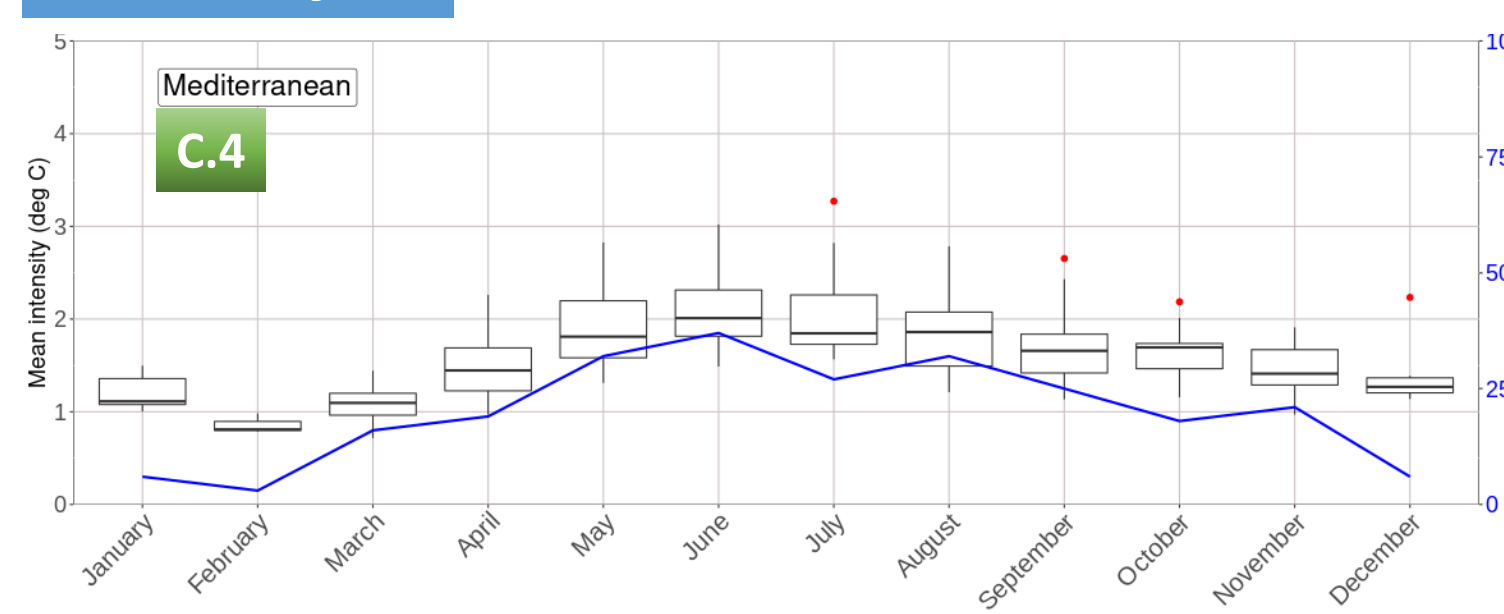
Spatial analysis



MHW events have been recorded throughout the whole Mediterranean basin from 1982 to 2021. More MHWs have been recorded in the northern half of the basin, with the highest number in the Gulf of Lyons, the northern Tyrrhenian sea and other sparse areas in the Adriatic and Eastern basins (fig. C.1). With a mean duration around 15 days, the mean MHW longer events were found in the Eastern basin (fig. C.2). Regarding mean MHW intensity (fig. C.3), a mean value of 1.6°C was found but with important regional differences focusing the highest mean intensities in the northern Western basin and northern Adriatic Sea.

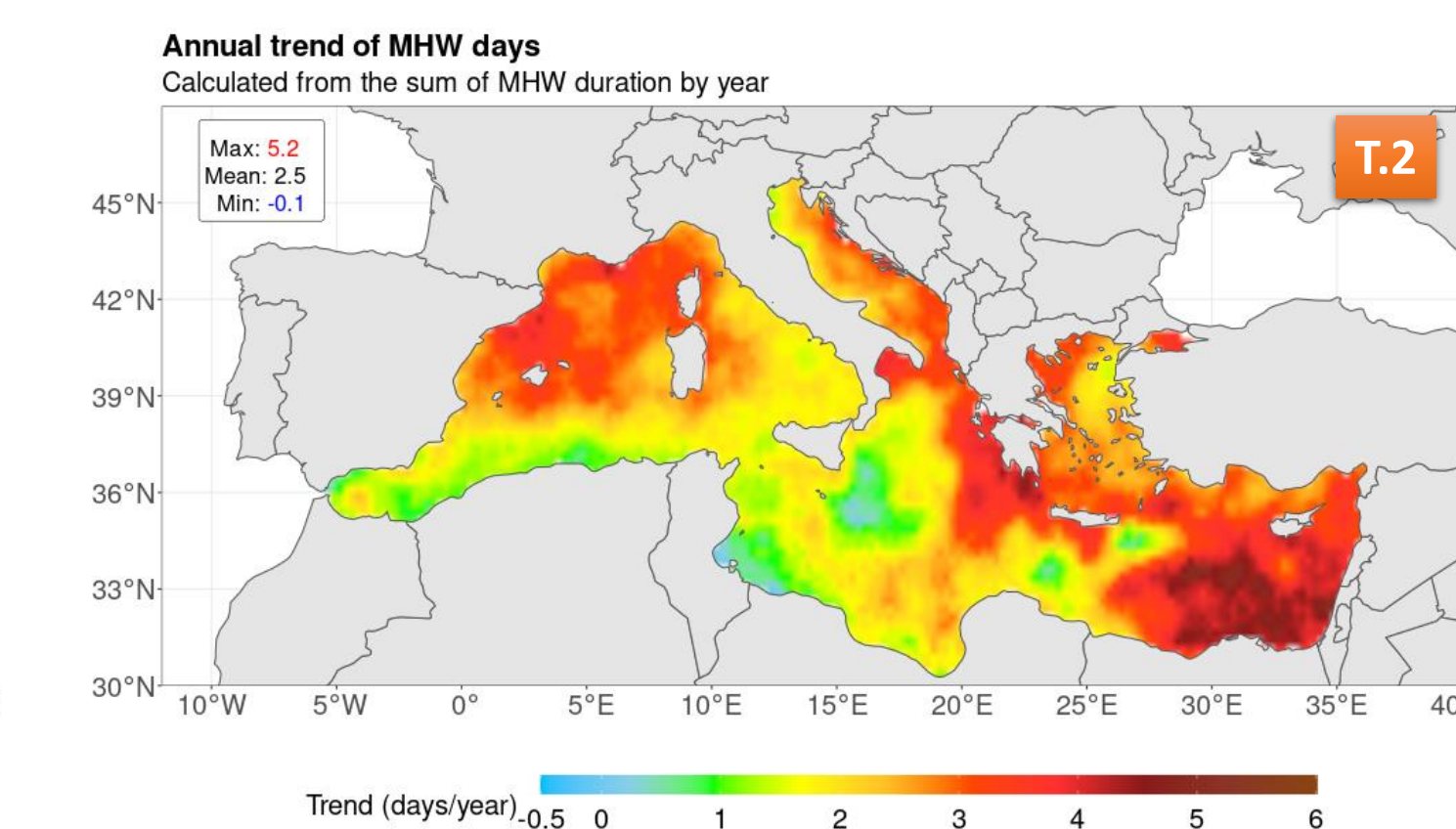
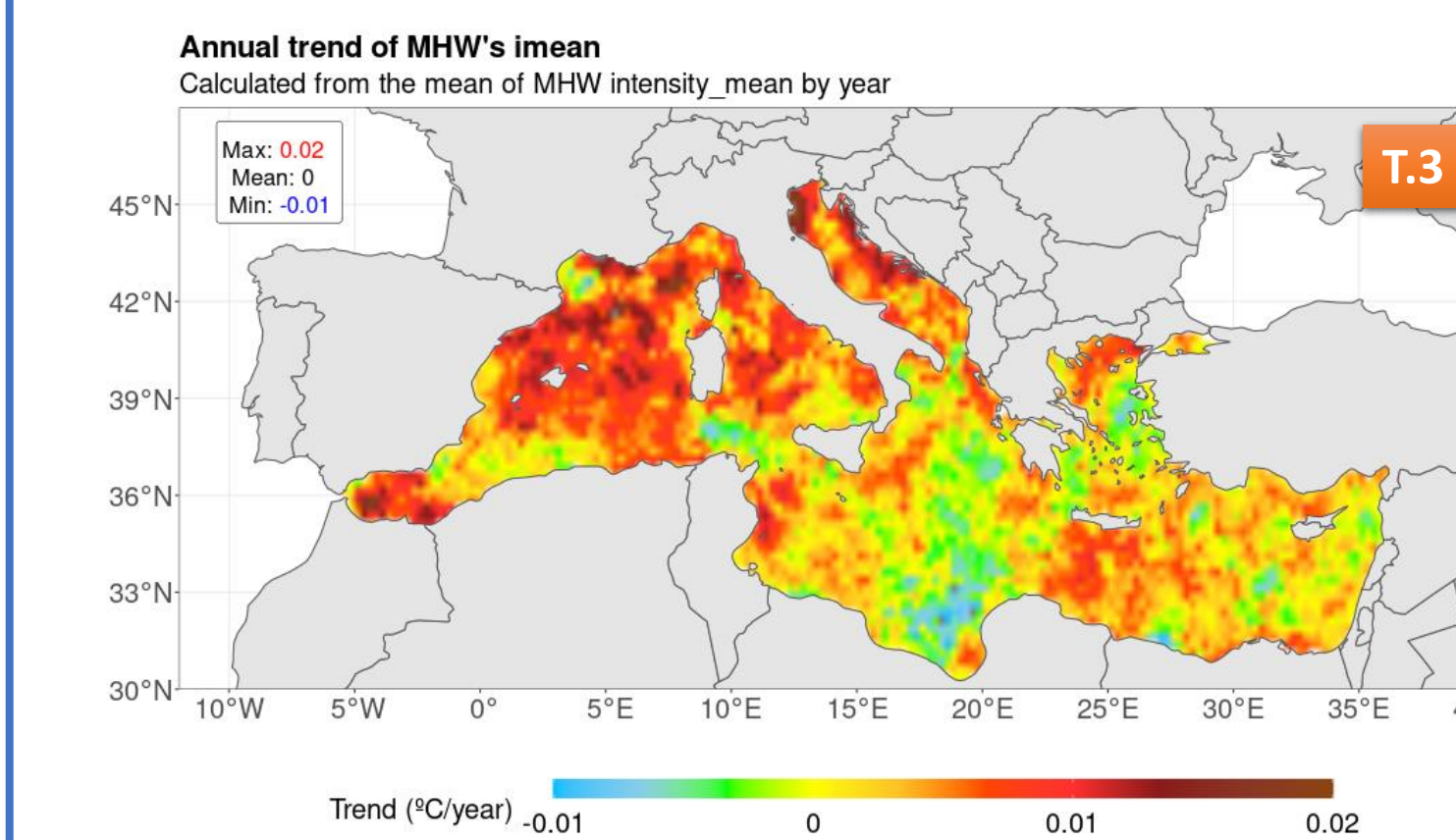
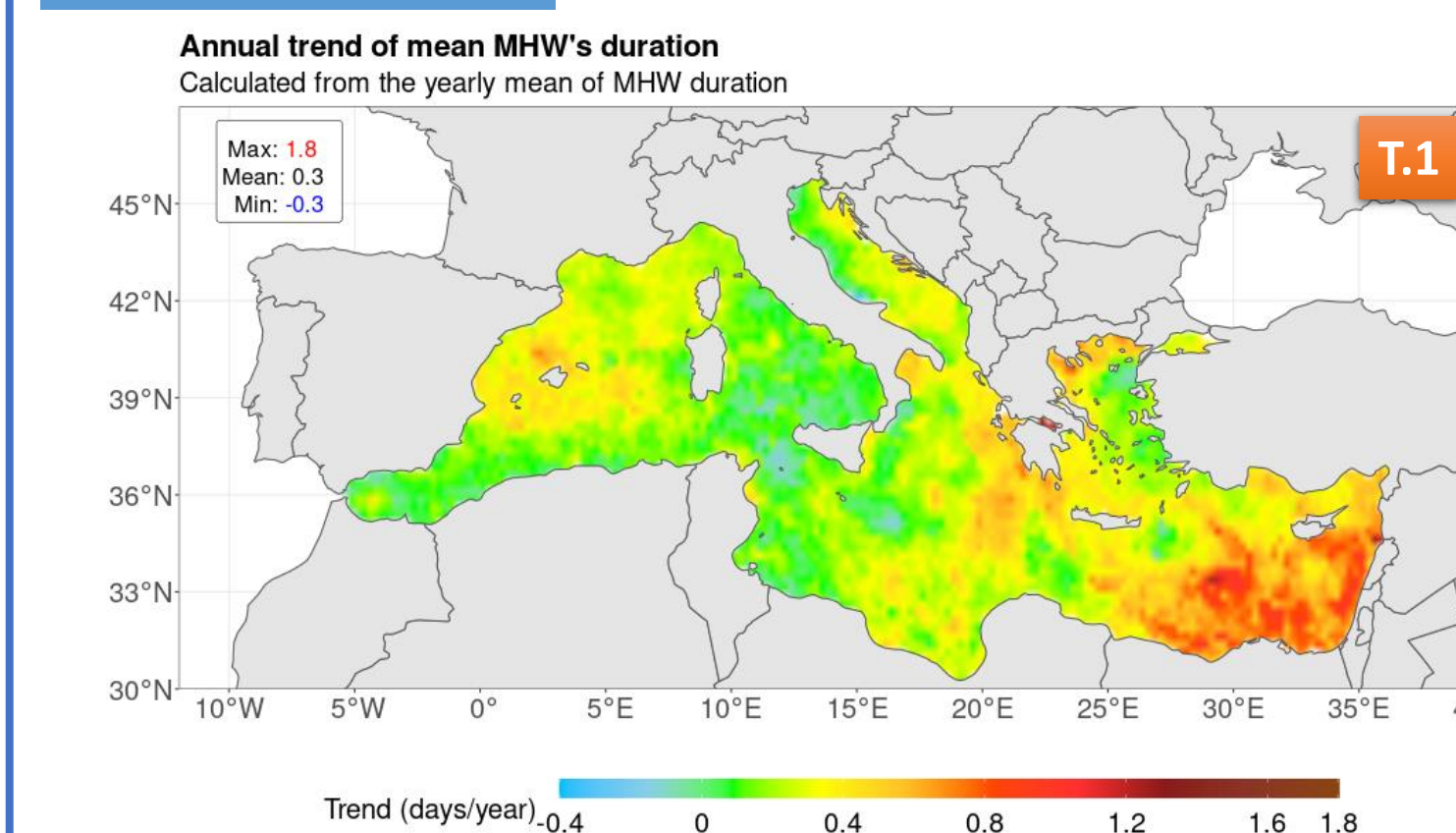
To analyse MHW annual behavior, only events covering at least a 5% of the basin area have been considered to avoid the accounting of small very local events. A clear annual cycle is found in the Mediterranean basin (fig. C.4) with the lower mean intensity in the winter months (December-March) and the higher ones for the summer season (May-August) and a progressive decline through autumn months. Same behavior is found when separating MHWs in categories based on their severity (fig. C.5). It has to be noted that in the Eastern Mediterranean the peak in number of events appear around May while Central and Western basins and the Adriatic show their maximum in July.

Annual cycle



TRENDS

Spatial analysis



Long term trend

As for the long-term trend, frequency and duration of MHWs show a progressive increase in the study period that strengthens since 2000, and specially in the last decade where the number and duration of MHWs has notably grown (triangles in figure T.4). As for the mean intensity of MHWs, its range of values has clearly widened in the study period (1982-2021), so that an increasing number of events with a higher mean intensity have been observed in the second half of the study period. However, the overall trend of the mean intensity is almost neutral, opposite to that for other characteristic magnitudes of MHWs.

Long-term trends for MHW magnitudes present general positive values through the study period (1982-2021) for the whole basin, although some regional differences arise. MHW mean duration (fig. T.1) grows at a mean rate of 3 days/decade, with the maximum in the easternmost basin, while the total number of MHW days in a year increases at 2.5 days/year (fig T.2), especially in most of the Eastern basin but also in the Western one. Although MHW mean intensity shows a global neutral trend for the whole Mediterranean basin, important regional differences arise (fig. T.3). Mean intensity trend presents a positive value in most of the Western basin but a negative value through an extensive area running from Greece to the Libyan coast and at some other sparse areas, especially in the Eastern basin. In a general manner, MHW have become more frequent, more intense and have higher duration in the last 40 years.

